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DIGITAL BANKING INNOVATIONS BY LEAD BANKS AND THEIR IMPACT ON AGRICULTURAL DEVELOPMENT IN PUNE REGION

Ms. Priya Sonavane
Research Scholar

Dr. Sanjay Motiram Gaikwad
Research Guide

Neville Wadia Institute of Management Studies & Research, Pune.

ABSTRACT

The rapid advancement of digital banking innovations has significantly transformed the financial landscape, particularly in the agricultural sector. This research paper explores the role of digital banking innovations implemented by lead banks in enhancing agricultural development in the Pune region. The study focuses on the effectiveness of digital tools and services such as mobile banking, online transactions, digital loan processing, and e-wallets in increasing financial inclusion, improving access to credit, and supporting the overall growth of the agricultural community. Through a comprehensive analysis of primary data collected from farmers, bank officials, the research examines the impact of these digital solutions on farming efficiency, cost management, and productivity. The findings highlight the opportunities and challenges of adopting digital banking practices in agriculture, offering recommendations to enhance the effectiveness of these innovations in fostering sustainable agricultural development. These include improving digital literacy among farmers, expanding digital infrastructure in rural areas, and tailoring digital products to meet the unique requirements of the farming community. By addressing these areas, lead banks can more effectively leverage digital innovations to support the agricultural sector's development and sustainability in the Pune region.

Keywords: Digital Banking, Lead Banks, Agricultural Development, Pune Region, Financial Inclusion, Digital Innovations, Farming Efficiency, Sustainable Agriculture.

1. INTRODUCTION

1.1 Agriculture's digitization

In India, a current movement attempts to increase productivity in all production, distribution, and consumption systems through the implementation of telecommunications and information technology (ICT) into agriculture. Another approach to describe this system is as a comprehensive agricultural system. The integrated agricultural system's main components are digital control equipment and data processing for network automation, digitalization, transmission, and collecting of agricultural operations. (Kadam et al., 2023) Furthermore, its major emphasis is on issues such as high-quality, organic manufacturing, labor strain reduction, and facility quality control. Second, creating a system that delivers food safety information is critical to satisfying customer demands throughout the production and distribution processes. Thus, the agricultural farming automation system must improve its usage of IT applications. Furthermore, advanced IT-based distribution technologies, such as distribution data convergence, must be deployed at the distribution and processing stages. These are the microscopic pieces of

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the digital farm system that contribute to the bigger database that makes up the complete agricultural system (Abbasi et al., 2022).

1.2 Overview of Digital Banking Innovations and Agriculture sector

Digital banking advances have altered the agriculture industry by improving the accessibility of financial services and enhancing productivity among peasants and agribusinesses. Mobile banking, internet transactions, digital wallets, as well as agricultural-specific financing services have simplified financial operations, allowing farmers to manage their money, obtain loans, and get subsidies straight into their accounts (Balkrishna et al., 2023). These innovations have also reduced the dependency on cash, minimized transaction costs, and improved transparency in financial dealings. Additionally, digital platforms facilitate better risk management through crop insurance they give real-time market data, allowing farmers to make educated choices about crop selection, price, and sales. Digital banking technologies play an important role in motivating farmers and generating sustainable development in the agriculture sector by promoting financial inclusion and agricultural production. (Seth et al., 2024).

1.3 Lead Bank Scheme

Around December 1969, the Governor of the Reserve Bank of India established the Lead Bank Scheme. The Scheme's main purpose is to construct a framework for the long-term growth of the regional economy's core sector by enhancing the flow of bank funding to priority sectors alongside other areas, as well as coordinating the efforts of all local banks to expand credit. A specific bank is entrusted with the lead bank role of the district in order to coordinate the operations within the district. Coordinating the operations and services of financial institutions and the government is within the purview of the head bank.(Ram, 2021).

1.4 Digital Transformation strategy

A digital transformation strategy is a detailed plan of action that explains a company's strategic repositioning in the context about the digital economy. The manner in which successful businesses operate is subject to change as consumer preferences evolve. They leverage emerging technology, innovate, and alter business and operating models. The subsequent figure provides a concise representation of the subject.

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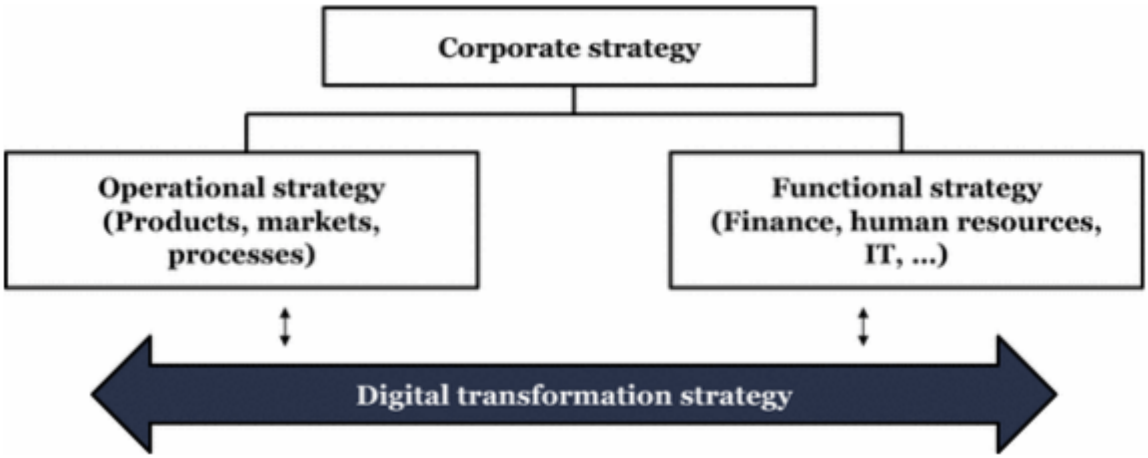

Fig.1 Digital transformation strategy
Source : (Goel, 2023)

It has been noted that digital transformation has enhanced the efficiency and effectiveness of various sectors. However, this is insufficient, as there are still some inadequacies that must be addressed. Additionally, there is a need for increased promotion and awareness of digital transformation in order to encourage more companies to adopt a new business model and achieve better returns, which will ultimately benefit society. (Ram, 2021).

1.5 Impact of Being Digital In the Agriculture Sector

Figure 2 illustrates the influence of digitalization and the Indian economy in increasing employment, improving the living standard of people, reducing risk and uncertainty, and increasing the literacy rate of the people. However, there are various things that the economy benefits from digitalization like reducing costs, saving time, increasing production and productivity, increasing skill and employability, and so on in every area of the economy, including agriculture (Balkrishna et al., 2023).

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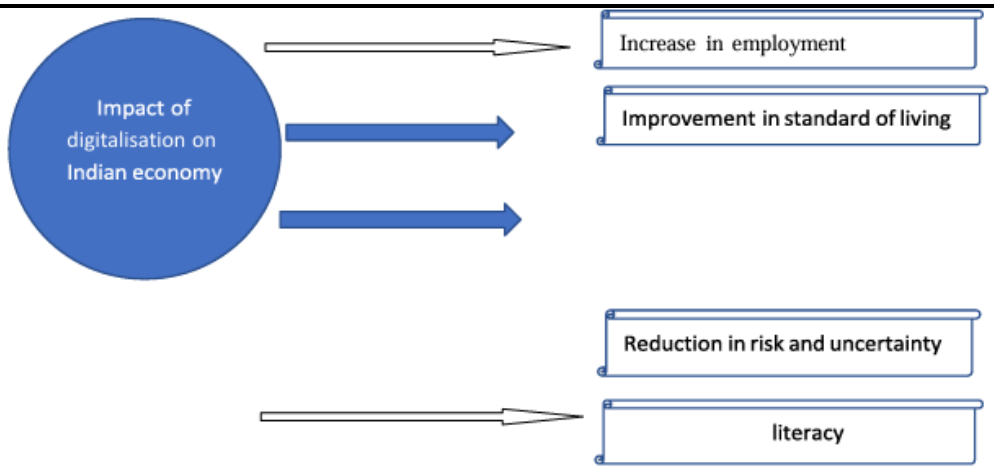

Fig.2 Impact of digitalization on Indian Economy
Source: Panchani, 2020

Increased productivity

Food producers have been equipped with an array of farm automation devices together with information management systems as a result of Agriculture 4.0, which has enabled them to enhance their agricultural and resource output. The adoption of technology advancements has resulted in a substantial shift from traditional, time-consuming methods to more modern, advantageous operations on farms. Furthermore, management may profit from using digital agriculture to link their organizational plans with the Sustainable Development Goals, creating more sustainable and resilient agri-food systems worldwide (Ganguly et al., 2017).

Enhanced farmer livelihood

Digital farming is critical for understanding agricultural science and enhancing agronomic techniques to get higher yields. Scalable and cost-effective solutions also enable big and medium-sized firms to pass on a tried-and-true set of techniques to farmers, especially in developing countries, to assist them in adopting more scientific agricultural methods. Agri-technology boosts agricultural production and reduces crop losses caused by pests, illnesses, and unexpected weather conditions. As a consequence, farmers may expect higher revenues at the conclusion of each season. Cropin's ICT solutions allow producers to fulfil quality criteria established by international certifying agencies, making it possible for farmers to earn a premium price for their goods.

Better market linkage

Among other things, digital solutions facilitate the virtual integration of numerous stakeholders, providing farmers with faster access to agricultural alongside farm supplies, banking services, and commodities dealers. This, in particular, aids smallholder farmers in surmounting some of

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their challenges, such as a lack of knowledge regarding current price levels for commodities and other significant market knowledge about the inability to compromise on payment, and the absence of having access to alternative market purchasers.

Informed decision-making

Another significant advantage of using a digital agricultural system is that it offers users with precise near-real-time data. A combination of farm and satellite-imaging-based data delivers actionable insights into productivity based on a broad range of growth circumstances, allowing farmers to better plan farm operations and manage resources. Furthermore, knowledge received at different points throughout the supply chain allows farmers to understand market demands and adjust crop output appropriately. Both commercial and public groups may exploit these information to prevent risks, enhance agricultural management, and guarantee minimum crop loss and food waste.

2. LITERATURE REVIEW

The Literature Review (LR) is an essential tool for comprehending the current state of knowledge in a certain research subject. It thoroughly reviews and synthesizes current research, ideas, and frameworks on the study subject, inconsistencies, and developing trends. A literature review provides context and justification for the study by reviewing past studies, which guides the creation of research questions, hypotheses, and procedures. It sheds light on the strengths and limits of previous research, providing a thorough review that informs and validates the present study's goals.

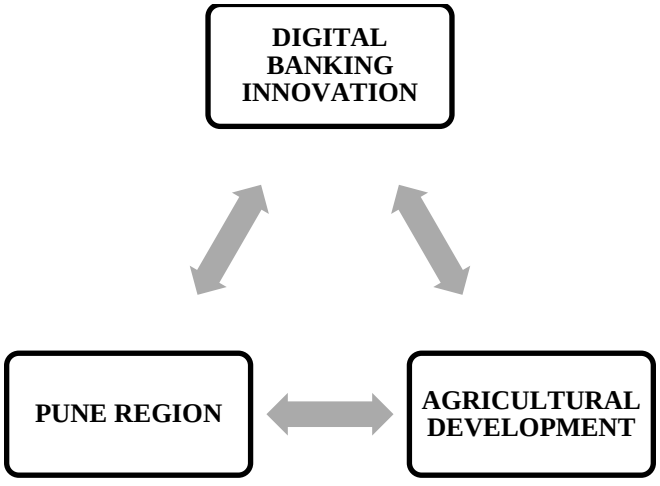

Fig.3 Conceptual Framework

Sanjeet Kumar Sah et.al (2024) the banking system of India is substantially different from the ones found in other Asian nations due to the country's distinctive economic, social, and geographic characteristics. India is characterized by a vast expanse, a diverse culture, a large population, and substantial regional economic disparities. The Indian banking system is at a crossroads, experiencing rapid alterations against a background of technology developments,

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regulatory reforms, and changing customer habits. This report looks at the development, difficulties, and prospects in India's banking system. It conducts a thorough review of secondary data, such as yearly reports, literature, and online resources. According to the report, technology improvements, regulatory changes, and variations in customer behaviour have all had a substantial impact on the banking business. The Reserve Bank of India oversees operations, while digital technology, strategic fintech alliances, and customer-centric methods are common. Despite issues like as non-performing assets, technological upheavals, and competition, the industry offers development prospects and needs coordination among regulatory agencies, financial institutions, and stakeholders for resilience and sustainability (Sah, 2024).

Acharya Balkrishna et.al (2023) Smart farming, precision agriculture, and other ICT-based interventions are assisting traditional agricultural systems in increasing their production and moving them towards sustainability, as the author has noted. To aid farmers in making crucial choices, data-driven technologies like smart sensors, remote sensing have evolved into essential components of agriculture. This innovation allows farmers to efficiently manage their farms in real time, which improves crop output, pest control, condition of the soil, and more. After conducting a thorough study of digital adoption via the lens of knowledge regarding the Indian agriculture business, we proceeded to describe significant information and communication technology (ICT) initiatives in great detail, and then we conducted a redundancy analysis to determine the sector's effect. Examining critical FMIS and important components of recognized systems used internationally reveals that, although being a significant agricultural country, India is still in the early phases of adopting digital solutions. We counted 29 local applications in India covering 23 different areas of agriculture, and we found 28 FMIS technologies that happen to live on a global scale. There were just a few of crop-specific applications found, and most of them were boring and mimicked other qualities. This report tells the story of digital participation in India's agricultural industry from a new perspective, contributing to India's Agri-stack mission.(Balkrishna et al., 2023).

D. M. Kadam et.al (2023) According to the findings of this research, the success of the agriculture sector has an impact on country's social and economic growth. Although the amount that is produced by agriculture for person has been progressively expanding recently, the sector's contribution to GDP has declined. The fundamental concern confronting the so-called rural Indian economy is the slowing of agricultural expansion. A variety of causes contribute to the slowdown, including insufficient public investment for R&D and irrigation, inefficient input delivery, fragmented land, obsolete tenancy rules, a lack of modern market and rural infrastructure, improper input pricing regulations, and so on. Agriculture has embraced technology as a way to address all of these concerns. Information and communication technology (ICT) and agriculture are collaborating to build a new growth engine that will improve the efficiency of all production, distribution, and consumption systems. This study focusses on the growth of Indian agriculture as well as the notion of digital technology(Kadam et al., 2023).

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Ratnakar Jaiswal et.al (2022) this study highlights the ongoing innovation in the field of digital banking and how it has contributed to the growth of the agribusiness sector. With the rise of digital payment systems, fintech companies are offering previously unheard of collateral-free loans to the agricultural industry. In order to take advantage of this opportunity, the agriculture sector has to become paperless and automate all of its financial activities. Helping small and medium-sized agricultural businesses (SMEs) embrace digital technologies will need concerted action from the government, banking sector regulators, and trade groups.(Seth et al., 2024).

Jeevan Kumar Cheruku et.al (2021) more resilient, efficient, productive, lucrative, and environmentally friendly farming practices are required in light of the COVID-19 pandemic, according to this study. Consequently, the Indian government placed a premium on making the most of contemporary technologies in order to guarantee ongoing food security and provide farmers a financial boost of 100%. This article delves into the digitalization of India's agricultural sector to help farmers increase their revenue by a factor of two and benefit the agricultural community as a whole. The strategy aims to increase smallholder farmers' incomes by using digital technology to enhance farm-level decision-making, increase productivity, and optimize resource utilization efficiency. Books, research articles, policy documents, reports from various government and non-governmental organizations, online databases, and discussion papers are some of the secondary sources used in this analytical study, which is based on a literature analysis. According to the research, governments should prioritize efforts to increase farmers' income in all areas of the food farming and supply chain.(Cheruku, 2021).

Melf-Hinrich Ehlers et.al (2021) this study show that digitalization is making steady progress in the agricultural sector. Agricultural policies that put an emphasis on sustainability are also becoming more important. There is a lack of clarity on how digitalization might enhance agriculture policy by mitigating negative impacts and maximizing positive outcomes. In order to better and more efficiently address sustainability challenges in farming, this research examines how digital technology could lead to other options of agricultural policy instruments and creative design requirements. Making use of both theoretical concepts and real-world examples across a European setting, it develops and applies a method of analysis that zeroes in on the several policy aspects affected by digitalization. We show that digital farm policy is more complex than just replacing traditional agricultural policy's use of analogue technology. It opens up new avenues for agricultural policy, such as novel ways to tackle problems more efficiently. Options like results-based subsidies are provided for more effective regional targeting and instrument customization. To aid in policy analysis and design adaptation, computerized information may be purposefully produced utilizing suitable instrument designs. Digitalization usually results in lower transaction costs and is especially beneficial for designs and equipment that rely heavily on information. The focus of agricultural policy might change from hands-on intervention to data-driven decision-making as a result of digitalization. Nevertheless, the study highlights the need of taking institutional interests and constraints into account, along with individual

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capabilities, when studying and implementing digitalization strategies for agricultural policy.(Ehlers et al., 2021).

Saurabh Kumar et.al (2016) An important tool for fighting poverty and ensuring food security in developing countries like India is the expansion and improvement of value chains in agriculture for both domestic and international markets, according to this study. Agricultural products grown by Indian farmers, such as fresh produce and fruits, have more room for higher value than regular crops; furthermore, with better access to processing, promotion, and distribution, the ultimate products' worth could rise. Indian vegetables and fruit exports are profiled in this article, along with their current status and future prospects in international markets, particularly in neighboring South Asian countries. Also included is an analysis of the fruit and vegetable value chains in India's agriculture sector. To get a deeper knowledge of the various approaches and methods used by India's agribusiness models, a comparative case study is useful. The research concludes by outlining key concerns related to value chains in agriculture and offering crucial recommendations for the launch and growth of such networks in India.(Kumar & Sharma, 2016).

3. RESEARCH METHODOLOGY

3.1 Data collection

For the research on "Digital Bank Innovations with Lead Banks and Effects on the Agricultural Development for the Pune Region," data would be gathered via surveys of farmers and agricultural companies. And banking professionals to assess the adoption and effects of digital banking. In-depth interviews with bank managers and local stakeholders will provide qualitative insights, (Cheruku, 2021) studies will evaluate the practical impact of digital banking on agriculture. Secondary data from financial reports, government publications, and regional economic indicators will support and contextualize these findings.

3.2 Sampling technique

A random sample strategy was used to choose participants among the target demographic. This strategy guaranteed that every person of the population maintained a comparable possibility of being enrolled in the sample, which reduced bias and increased the results' generalizability. By randomly choosing respondents, the group being studied was more likely to correctly represent elements of the larger consumer base, thereby improving the validity as well as reliability of the research findings.(Seth et al., 2024).

3.3 Objective

- To assess the impact of these innovations on agricultural development in the Pune region.

3.4 Hypothesis

H1: Digital banking innovations by lead banks have a significant positive impact on agricultural development in the Pune region.

H0: Digital banking innovations by lead banks do not have a significant positive impact on agricultural development in the Pune region.

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4. DATA ANALYSIS AND INTERPRETATION

In this part, we give a full analysis of the obtained data, presenting crucial insights that provide light on the demographics and dynamics of the chosen region. Descriptive statistics is a field of statistics concerned with data collection, analysis, interpretation, presentation, and organizations. Its major goal is to summarize and characterize the key elements of a dataset, offering a clear and simple summary of the information available. Descriptive statistics assist researchers, analysts, and decision-makers make sense of data by reducing complicated information to useful patterns and insights.

Table 1 Demographic Table

Gender	**Frequency**	**Percentage**
Male	49	70%
Female	21	30%
Age	**Frequency**	**Percentage**
Under 25	20	28%
25-35	41	59%
45-54	9	13%
Occupation	**Frequency**	**Percentage**
Farmer	38	54%
Agribusiness owner	13	18%
Bank employee	12	17%
Govt. Official	7	10%

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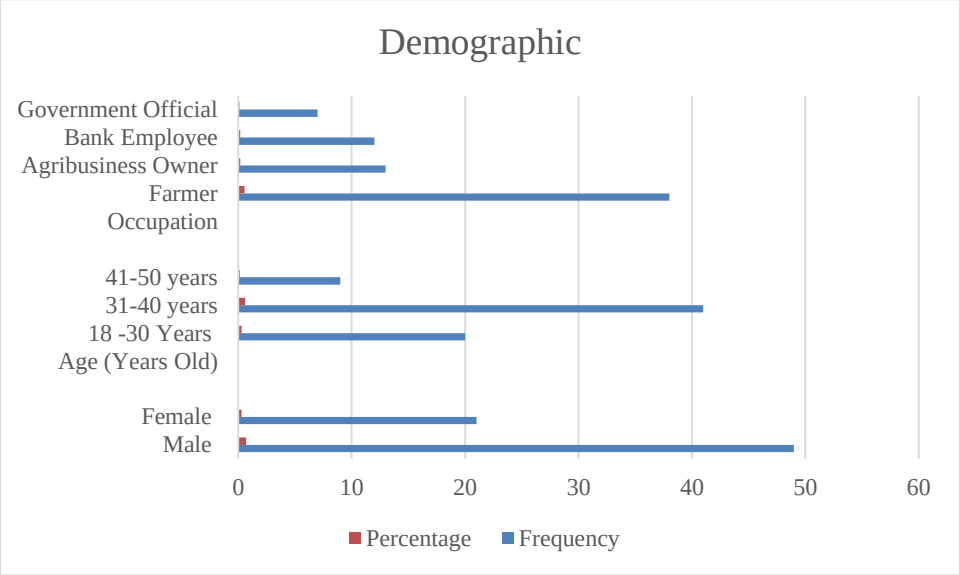

Fig. 4 Demographic Graph

The demographic data indicates a diverse representation of respondents in terms of gender, age, and occupation. The majority of participants are male, comprising 70% (49 respondents), while females make up 30% (21 respondents). In terms of age distribution, a significant portion of the respondents, 59% (41 respondents), are between 31-40 years old, followed by 28% (20 respondents) in the 18-30 years age group, and 13% (9 respondents) are between 41-50 years. This suggests that most respondents are in their early to mid-career stages. Regarding occupation, more than half of the respondents, 54% (38 respondents), are farmers, highlighting a strong representation from the agricultural sector. Additionally, 18% (13 respondents) are agribusiness owners, 17% (12 respondents) are bank employees, and 10% (7 respondents) are government officials. This occupational mix provides a balanced viewpoint from major stakeholders engaged in agriculture plus banking, which is vital for evaluating the influence of digital banking developments on agricultural growth in the Pune area.

Table 2 the Reliability Statistics

Variable	Cronbach's Alpha
Independent Variable: Digital Banking Innovations by Lead Banks	0.795
Dependent Variable : Agricultural Development in the Pune Region	0.848
Demographic variables (e.g., age, gender, occupation)	0.818

A high level of insider consistency among the assessed variables is shown by the study's reliability statistics. Indicating the survey questions or items used to assess these variables are dependable, All of Cronbach's Alpha values are above the allowed limit of 0.7. To be more precise, the items used to evaluate "Digital Banking Innovations among Lead Banks," the independent variable, maintain a high level of internal consistency (Cronbach's Alpha = 0.795).

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A high degree of dependability in capturing many facets of agricultural growth is shown by the dependent factor, "Agricultural Development for the Pune Region," which displays a Cronbach's Alpha value 0.848. Furthermore, the demographic variables, including gender, age, and employment, had a Cronbach's Alpha regarding 0.818, which provides further evidence of their reliability in assessing the respondents' demographic traits.

Table 3 Analysis of statistics

Model Summary				
Model	R	R-Square	Adjusted R-square	Standard error for this estimate
1	.229[a]	.053	.049	.674
a. Predictors: Digital Banking Innovations by Lead Banks				

A statistical synopsis of the analysis's predictor-outcome relationships is given in the model summary. With an R Squared value of 0.053, we can see that the independent variable "Digital Banking Innovations for Lead Banks" explains about 5.3% of variance in the dependent variable. "Agricultural Development across the University of Pune Region." Although improvements in digital banking do affect agricultural growth to a lesser extent than other variables not taken into account by this model, the low R Square value indicates that these other factors account for a larger portion of the variation in agricultural development results. The above modified coefficient squared value is 0.049, thus being substantially lower but still reveals the same result, After accounting for the increased number variable drivers in the model. The model's assumptions deviate greatly from the actual numbers, as evidenced by a standard variation of 0.674.

Table 4 Test of Anova

ANOVA[a]						
Model		Addition of square	df	Mean Square	F	Sig.Value
1	Regression	7.510	1	7.510	16.520	.000[b]
	Residual	135.477	298	.455		
	Total	142.987	299			
a. DV: Agricultural Development in the Pune Region						
b. Predictors: Digital Banking Innovations by Lead Banks						

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The ANOVA results show that the regression model significantly improves the prediction of "Agricultural Development in the Pune Region" ($F = 16.520$, $p < 0.001$). The model explains a modest part of the variance, but the predictor variable, "Digital Banking Innovations by Lead Banks," has a statistically significant impact.

Coefficients						
Model		Irregular ratio		Standardized equations.	t	Sig. Value
		B	Std. Error	Beta		
1	(Constant)	3.360	.204		16.484	.000
	61. Perishable nature of Fruits	.201	.049	.229	4.064	.000
a. Dependent Variable: Agricultural Development in the Pune Region						

The coefficients table describes the connection between the variable that predictions and the dependent variable. The constant term is 3.360, which represents the estimated value of "Agricultural Development in the Pune Region" when the predictor, "Digital Banking Innovations by Lead Banks," is zero. This coefficient is highly significant ($t = 16.484$, $p < 0.001$). The predictor variable, "61. Perishable nature of Fruits," has an unstandardized coefficient of 0.201 with a standardized value (Beta) of 0.229. This demonstrates the effect of each unit improvement in the perishability of fruits, the agricultural development in the Pune region is expected to increase by 0.201 units. The coefficient is statistically significant ($t = 4.064$, $p < 0.001$), suggesting that the perishable nature of fruits has a meaningful impact on agricultural development.

Result and Discussion

The study's findings suggest that "Agricultural Development of the Pune Region" is statistically significant, albeit modestly, influenced by "Digital Banking Technologies by Lead Banks." The regression approach explains only 5.3% of all the variability in agricultural development, just like demonstrated by R Square value of 0.053. The model's general validity is confirmed by the ANOVA results, which show a coefficient of variation of 16.520 alongside a p-value of less than 0.001, despite the low explanatory power. This suggests that digital banking improvements are a valid predictor. The unstandardized incidence of 0.201 and the standardized coefficient (Beta) during 0.229, additionally statistically significant, the coefficients analysis shows that the transitory nature of fruits has a favorable influence on agricultural growth. These results indicate that in the Pune region, the perishable character of produce significantly influences agricultural outcomes, despite the fact that digital banking innovations foster agricultural development. The results of the research suggest that although "Digital Banking Developments by Lead Banks" offers a statistically significant influence on agricultural growth in the Pune area, the total

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explained variation is very moderate (5.3%). This suggests that while digital banking innovations contribute to agricultural development, their influence is limited compared to other factors. The high reliability of the measurement instruments used in the study supports the robustness of these findings. The significant ANOVA result confirms that the predictor variable has a meaningful impact on agricultural development, reinforcing the relevance of digital banking innovations in this context. Furthermore, the significant coefficient for the perishable nature of fruits highlights its positive effect on agricultural development. This indicates that addressing the challenges associated with perishable fruits could enhance agricultural outcomes. Overall, while digital banking innovations play a role, the relatively low R Square value suggests the need for further research to identify additional factors that contribute to agricultural development in the Pune region.

5. CONCLUSION

Finally, the research shows that digital banking advances by leading banks have a considerable but limited influence on agricultural growth in the Pune area. While these innovations such as mobile banking, online transactions, and digital financial services enhance access to credit, improve financial management, and promote financial inclusion among farmers, their total impact is determined by several other elements, such as infrastructure, awareness levels, and the perishable nature of agricultural products. Despite the modest contribution to agricultural growth, digital banking remains a valuable tool for enhancing efficiency and supporting the financial needs of the agricultural sector. For a more substantial impact, it is essential to integrate these digital solutions with broader development strategies, including infrastructure improvement, capacity building, and awareness campaigns, to fully realize their potential in fostering agricultural growth in the Pune region. The study reveals that digital banking innovations, while statistically significant, have a relatively modest impact on agricultural development in the Pune region, explaining only a small portion of the variance in outcomes. The high reliability of the measurement tools used supports the validity of these findings. The significant positive effect of the perishable nature of fruits on agricultural development underscores the importance of addressing this factor to improve agricultural practices and outcomes. Overall, while digital banking innovations contribute to agricultural development, their impact is limited compared to other variables. Future research should explore additional factors influencing agricultural development to provide a more comprehensive understanding and to develop targeted strategies for enhancing agricultural growth in the Pune region.

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